

CLAIMS

1. Optical scanning device (1) for the production of a 2D computer image of an illuminated liquid or humid biological sample observed by transparency, characterized in that

an even thickness of the liquid biological sample (30) is disposed in a tank (3) optically enclosed between an illumination assembly (2) and an optical sensing assembly (4),

the optical sensing assembly having a moving part able to move in a plane parallel to the sample as to scan an area of the sample of sensibly equal thickness,

the illumination assembly having a luminous source sensibly homogeneous in the scanned area and including towards the sample, an optical grid filter (25) with a surface parallel to the plane and transmitting only light rays sensibly perpendicular to its surface.

2. Optical scanning device according to claim 1, characterized in that the biological sample can, in addition, be observed by reflection and that the optical sensing assembly has, in addition, opposite to the sample as regard the moving part, a black end (41) and a lighting assembly, as to allow illumination of the sample from the illumination assembly or from the optical sensing assembly or from both.

3. Optical scanning device according to claim 1, characterized in that the luminous source of the illumination assembly is a flat lamp disposed above the tank.

4. Optical scanning device according to claim 1, characterized in that the luminous source of the illumination assembly includes a source (20) of light rays emitting light rays towards a luminescent plate (21) disposed parallel to the plane, light rays re-emitted (22) by the luminescent plate towards the sample passing through a frosted plate (23) parallel to the plane before being (24) filtered by the optical grid filter (25) and then reaching the sample (30).

5. Optical scanning device according to claim 2, characterized in that the lighting assembly of the optical sensing assembly has lateral stationary fluorescent tubes (40).

6. Optical scanning device according to claim 2, characterized in that the lighting assembly of the optical sensing assembly has a moving fluorescent tube attached to the moving part of the optical sensing assembly.

7. Optical scanning device according to claim 1, characterized in that the moving part of the optical sensing assembly is an optical sensor which is a single optical transducer movable along two perpendicular directions in the plane as to scan the area.

8. Optical scanning device according to claim 1, characterized in that the moving part of the optical sensing assembly is an optical sensor (42) which is a linear sensor having a plurality of unitary optical transducers disposed along a sensing line, the optical sensor being movable in a direction perpendicular to the sensing line in the plane as to scan the area.

9. Optical scanning device according to claim 1, characterized in that the moving part of the optical sensing assembly is a linear mirror disposed along a mirror line, the linear mirror being movable in a direction perpendicular to the mirror line in the plane as to scan the area and reflecting said area to a fixed optical sensor.

10. Optical scanning device according to claim 1, characterized in that the sample tank is a closed chamber having at least one port, two opposite walls parallel to the plane and peripheral walls, at least said two opposite walls being transparent.

11. Optical scanning device according to claim 1, characterized in that the sample tank is an open chamber with a sample free surface (31) and having a bottom wall (32) parallel to the plane and peripheral walls, at least said bottom wall being transparent.

12. Optical scanning device according to claim 11, characterized in that the peripheral walls are stepped (33) (39) by

mean of a transparent material to allow the sample to overstep said step in order to avoid a possible meniscus in the image area.

13. Optical scanning device according to claim 12, characterized in that at least one of the peripheral walls has a gutter.

14. Optical scanning device according to claim 1, characterized in that the optical scanning device has a magnifier as to have an image of the sample which is enlarged.

15. Optical scanning device according to claim 2, characterized in that the illumination assembly (2) is under the sample tank (3) and the optical sensing assembly (4) is above the sample tank, said sample tank being an open chamber joint to the illumination assembly and having peripheral walls and a transparent bottom wall (32) parallel to the plane which is horizontal, and in that the optical sensing assembly is tiltable along one of its edge as to open the device and gain access to the sample tank and, conversely, to close it.

16. Optical scanning device according to claim 2, characterized in that the illumination assembly (2) is above the sample tank (3) and the optical sensing assembly (4) is under the sample tank, said sample tank being an open chamber joint to the optical sensing assembly and having peripheral walls and a transparent bottom wall (32) parallel to the plane which is horizontal, and in that the illumination assembly is tiltable along one of its edge as to open the device and gain access to the sample tank and, conversely, to close it.

17. Optical scanning device according to claim 16, characterized in that the optical sensing assembly is tiltable supported by a support (5) as to incline the plane from a position where it is horizontal, to a position where it is inclined as to drain the sample tank and, conversely, to return to an horizontal position of the plane.

18. Optical scanning device according to claim 17, characterized in that the illumination assembly and the optical

sensing assembly are interlocked as to allow the draining of the sample tank only when the device is open.

19. Process of operation of an optical scanning device (1) for the production of a 2D computer image of an illuminated liquid or humid biological sample observed by transparency or by reflection, characterized in that an optical scanning device according to claim 17 is used and in that:

- in a preparation phase, the device being open, a sample is introduced in the tank,
- in a scanning phase, the device being closed, the sample is scanned as to produce data corresponding to an image of the sample,
- in a flushing phase, the device being open, the optical sensing assembly is tilted as to drain the sample tank.

20. Process of operation according to claim 19, characterized in that during the scanning phase, in order to illuminate the liquid or humid biological sample, either or both the luminous source of the illumination assembly and the lighting assembly of the optical sensing assembly are switched on.

21. Process of operation according to claim 19, characterized in that it has an additional phase in which objects are selected in an initial image and that the initial image minus the objects is subtracted from the initial image as to keep only the objects in an object image.

22. Computer program for the operation of an optical scanning device when said device is connected to said computer, characterized in that the optical scanning device is according to claim 1 and in that it has means for controlling the device and analyzing the image received from the device into the computer, the means for analyzing being at least one chosen from at least:

- an image displaying sub-process,
- an image contrast correction sub-process,
- an image luminosity correction sub-process,
- an image color correction sub-process,
- an image color to gray or black/white conversion sub-process,

- an image gray to false color conversion sub-process,
- an image median filter as to reduce and/or remove isolated artifact pixels in the image,
- a threshold object(s) selection in the image sub-process,
- at least one calculation sub-process of attributes of object chosen from at least: surface, length, width, main axles, minimum Ferret diameter, maximum Ferret diameter, mean Ferret diameter, perimeter, convex perimeter, two different measures of elongation, density, roughness, number of holes, binary centroids position, gray level along a determined direction (X, Y, length, width, selected direction), moment (global or along X1Y1, X0Y2, X2Y0) as binary or gray level, angle between the first two main axles, mean and minimum and maximum of value of the gray level, sum of the of the square of gray level,
- display and storage/retrieval of calculated attributes in association with at least object localization and image reference data,
- an image selection of objects according to at least one-dimensional parameter,
- an image selection of part or entirety of the image sub-process,
- a marking (encircling, squaring, highlighting and or specific color attribution) of the selection,
- a cutting or pasting sub-process for a selection,
- an image associated context information display and entry/correction,
- an image retrieval and storage sub-process with possible associated context information.